

Rubber Research Scheme

(Ceylon.)

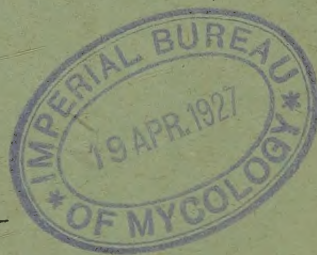
Fifth Report of the Executive Committee

— TO THE —

Members of the Rubber Research Scheme.

PROCEEDINGS DURING THE YEAR

1926.



To be presented at the Ordinary General Meeting,

April 22nd, 1927.

Rubber Research Scheme

(Ceylon.)

Fifth Report of the Executive Committee

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Members of the Rubber Research Scheme.

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To be presented at the Ordinary General Meeting,

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Rubber Research Scheme (Ceylon).

Peradeniya,

March 22nd, 1927.

NOTICE.

Notice is hereby given that the Fifth Ordinary General Meeting of the Rubber Research Scheme (Ceylon) will be held at the Chamber of Commerce Rooms, Colombo, on the 22nd of April, 1927, at 11 a.m. for the following purposes:—

1. To receive and consider the Report of the Executive Committee for the year ended December 31st, 1926, and the Annual Statement of Accounts and Balance Sheet as at December 31st, 1926.
2. To receive and consider Reports by the Technical Officers of the Rubber Research Scheme.
3. To receive and consider Report of the London Advisory Committee.
4. To elect Auditors for the coming year and fix their remuneration.
5. To transact any other business that may arise.

By order,

J. MITCHELL,

Organising Secretary.

Committees of the Rubber Research Scheme,

as at December 31st, 1926.

EXECUTIVE COMMITTEE.

THE HON'BLE MR. F. A. STOCKDALE, C.B.E.
(Chairman).

THE HON'BLE LT.-COL. T. Y. WRIGHT.

Mr. C. W. BICKMORE.

„ A. D. CALLENDAR.

„ D. S. CAMERON.

„ C. E. A. DIAS.

„ W. COOMBE.

„ J. FARLEY ELFORD (on leave).

„ P. S. BRIDGE (acting).

Mr. CLIFFORD FIGG (on leave).

„ A. S. COLLETT (acting).

„ G. B. FOOTE.

„ F. H. LAYARD.

„ G. P. MADDEN (on leave).

„ D. FINCH NOYES (acting).

Dr. W. SMALL.

Mr. L. M. W. WILKINS.

„ J. MITCHELL (Secretary).

TECHNICAL COMMITTEE.

THE HON'BLE MR. F. A. STOCKDALE (Chairman).

Dr. W. SMALL, Mycologist, Department of Agriculture.

„ J. C. HUTSON, Entomologist, Department of
Agriculture.

Mr. A. W. R. JOACHIM, Chemist, Department of
Agriculture.

Mr. H. W. ROY BERTRAND.

„ T. E. H. O'BRIEN, Chemist of Scheme.

„ R. A. TAYLOR, Physiological Botanist of Scheme.

„ J. MITCHELL, Organising Secretary of Scheme
(Secretary).

LONDON ADVISORY COMMITTEE.

Representatives of Rubber Growers' Association	...	{ MR. P. J. BURGESS, M.A., F.C.S. (Chairman)* MR. H. ERIC MILLER. MR. HERBERT WRIGHT.*
Representatives of Ceylon Planting Interests	...	{ SIR EDWARD ROSLING.* SIR STANLEY BOIS, MR. G. H. MASEFIELD.*
Representatives of Rubber Manufacturing Companies	...	{ MR. W. C. SMITH.* MR. W. A. WILLIAMS.* DR. D. F. TWISS, F.I.C., F.I.R.I.*
Representative of the Research Association of British Rubber and Tyre Manufacturers	...	LT.-COL. J. BEALY CLARKE.*
Representatives of Imperial Institute	...	{ LT.-GEN. SIR WILLIAM FURSE.* LT.-COL. SIR DAVID PRIN.*
Botanists	...	{ SIR J. B. FARMER, F.R.S.* MR. H. N. RIDLEY, C.M.G., F.R.S.*
Secretary	...	MR. J. A. NELSON, B. Sc.*

*Members of Technical Sub-Committee.

Auditors:

DUNCUM, WATKINS, FORD, & CO.

Offices:

... RUBBER RESEARCH SCHEME, PERADENIYA.

Bankers:

NATIONAL BANK OF INDIA, LTD.

Research Laboratories:

... CULLODEN ESTATE, NEBODA.

Scientific Staff:

CEYLON.

Mr. J. MITCHELL, A. R. C. Sc., Organising Secretary.

Mr. T. E. H. O'BRIEN, B. Sc., A. I. C., Chemist.

Mr. R. A. TAYLOR, B. Sc., Physiological Botanist.

Mycologist (vacant).

LONDON.

Mr. G. MARTIN, B. Sc., A. I. C., Chemist,
(Superintendent)

Mr. W. S. DAVEY, B. Sc., A.I.C., Chemist.

Mr. F. L. ELLIOTT, F.I.C., Chemist.

Mr. L. L. STEWART, Laboratory Assistant.

EXECUTIVE COMMITTEE'S REPORT TO MEMBERS.

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GENTLEMEN,

The Executive Committee of the Rubber Research Scheme (Ceylon) submits its report for the year ended December 31st, 1926.

Membership.—A complete list of Members is given in Appendix No. 1 of this report from which it will be noted that at December 31st, 1926, there were 102 Rubber Growers' Association Members and 109 Rubber Research Scheme Members making a total of 211 Members in all. At December 31st, 1925, there were 104 Rubber Growers' Association Members and 95 Rubber Research Scheme Members.

Subscriptions.—The subscriptions from local subscribers on account of the year 1926 amounted to Rs. 31,599/84 as compared with Rs. 24,706/08 on account of 1925. Owing to the high rate of exchange during the year a sum of Rs. 4,837/- less was received than would have been the case if conversion from sterling to local currency had been made at Rs. 15/- to the £ sterling.

The Ceylon Government Grant for 1926/27 was Rs. 67,500/- which is the same as for 1925/26. The Rubber Growers' Association paid into the London Account the usual amount of £2,000.

Executive Committee.—Mr. F. J. Poyntz Roberts resigned and Mr. A. F. B. Smeaton was appointed to fill the vacancy.

The Chairman of the Planters' Association of Ceylon was appointed an Ex-Officio Member of the Committee.

Dr. W. Small (Mycologist, Department of Agriculture) was appointed to fill the vacancy created by the resignation of Mr. T. Petch.

The Hon'ble Lt.-Col. T. Y. Wright and Messrs. Clifford Figg, G. P. Madden, D. S. Cameron and J. Farley Elford proceeded on leave to Europe and the Hon'ble Mr. Neil G. Campbell and Messrs. A. S. Collett, D. Finch Noyes, and P. S. Bridge were respectively appointed Acting Members.

Meetings of the Committee were held on January 22nd, April 16th, July 16th, October 15th, December 6th, and December 17th, 1926, and printed copies of the Minutes of these Meetings have been circulated to all Members of the Rubber Research Scheme.

London Advisory Committee.—The vacancy created by the resignation of Sir Wyndham R. Dunstan was filled by the appointment of Lt.-Genl. Sir William Furse (Director, Imperial Institute) and Lt.-Col. Sir David Prain was appointed an additional representative of the Imperial Institute.

Mr. Percy Rosling resigned and Mr. W. C. Smith (Callanders Cable & Construction Co., Ltd.) was appointed to fill the vacancy.

Mr. G. H. Masefield was appointed to fill the vacancy created by the resignation of Mr. G. H. Golledge.

Meetings of this Committee were held on February 19th, May 21st, July 16th, and October 29th, 1926, and copies of the Minutes of these Meetings have been supplied to all Members of the Executive Committee. The Report of this Committee and the Report of the Technical Officers working at the Imperial Institute is attached.

Technical Committee (Ceylon).—Dr. W. Small (Mycologist, Department of Agriculture) and Mr. A. W. R. Joachim (Chemist, Department of Agriculture) were appointed to fill the vacancies created by the resignation of Mr. T. Petch and the death of Mr. M. Kelway Bamber.

Mr. R. H. Stoughton-Harris (Mycologist, Rubber Research Scheme) resigned on leaving the Colony to take up permanent residence in England.

Meetings of this Committee were held on February 22nd, May 22nd, August 24th, and December 17th, 1926, and copies of the Minutes of these Meetings have been circulated to Members of all Committees of the Scheme.

Technical Sub-Committee (London).—Mr. W. C. Smith was appointed to fill the vacancy created by the resignation of Mr. Percy Rosling.

Meetings of this Committee were held on February 19th, May 31st, July 16th, and October 29th, 1926, and copies of the Minutes of these Meetings have been supplied to all Members of the Technical Committee (Ceylon).

Technical Officers.—Mr. R. H. Stoughton-Harris (Mycologist) resigned his appointment on September 2nd, 1926, and the necessary steps for the appointment of a successor have been taken. Difficulty has been experienced in securing a suitable officer to fill this vacancy.

Mr. T. E. H. O'Brien (Chemist) proceeded on leave to Europe on June 10th, 1926, and resumed his duties on December 15th, 1926. Mr. O'Brien completed five year's service with the Research Scheme on December 18th, 1926, and has accepted re-engagement for a further period of 4 years.

Accounts.—The audited statement of Accounts and Balance Sheet for the year 1926 is given in Appendix 4 of this report.

The reduction in the amount of salaries to Technical Officers is owing to the resignation of Mr. Stoughton Harris in September and the inability of the Research Scheme to fill the vacancy before the end of the year.

The increase in travelling expenses arises from the fact that sanction was given to the Technical Officers to visit estates in connection with budding and selection of high yielders and with spraying demonstrations.

A liberal amount has been written off for depreciation of buildings, apparatus and furniture.

It will be noted that there has been an excess of income over expenditure of Rs. 30,438/59 as compared with Rs. 27,184/46 for 1925.

The Balance Sheet shows that cash on Fixed Deposit, and Current Account amounts to Rs. 131,490/69 as compared with Rs. 115,233/07 at the end of 1925. From the Cash Balance the sum of Rs. 53,420/08 is earmarked for Sundry Creditors, Rs. 6,645/25 is on Current Account from the bonuses and passage fund leaving a net balance in the General Fund of Rs. 71,425/36 to be carried forward to 1926.

The Experiment Station Account appears as a new item in the Assets of the Scheme on which the sum of Rs. 8,709/35 was expended during the year.

Laboratories.—The Chemical Section of the laboratories now requires extension and estimates have been secured. This will be taken in hand as soon as funds permit.

Bungalows.—During the year an extension to the bungalow on Culloden Estate occupied by the Mycologist has been completed and a garage for the same has been added.

Rubber Experiment Station.—In addition to the 50 acres of Crown land at Nivitigalakele near Matugama which your Committee secured last year application has been made for an adjacent block of 13 acres making 63 acres in all. Of this area approximately 12 acres have been opened up on the contour platform terracing system devised by Mr. C. E. A. Dias and have been planted with stocks from known high yielding trees for budding purposes.

Mr. R. A. Taylor (Physiological Botanist) has been placed in charge of the Station and is giving special attention to all the problems relating to budding.

On July 8th Mr. Taylor gave an address on the technique of bud-grafting at the Royal Botanic Gardens, Peradeniya, followed by a demonstration.

Spraying of Rubber.—During March, the Research Scheme Mycologist (Mr. R. H. Stoughton-Harris), paid a visit to South India in order to become acquainted with the methods of spraying being carried out there. On his return he carried out several demonstrations in different districts and published a leaflet giving full details. Several estates have sprayed small areas but the results have not been very satisfactory. It is hoped to make further trials during 1927 with improved apparatus supplied by Messrs. Drake and Fletcher and with apparatus supplied by another firm of manufacturers of spraying machinery and to compare results.

Agricultural Conference.—The Technical Officers of the Research Scheme contributed papers on subjects of current importance to the Rubber Industry at the Agricultural Conference held at Peradeniya on March 11th. These papers were published in the local press and in the Special Conference Number of the Tropical Agriculturist.

District Meetings.—By arrangement with the District Planters' Associations of Sabaragamuwa, Kelani Valley, and Kalutara, Mr. R. H. Stoughton-Harris gave addresses on spraying of rubber which were followed by a demonstration of spraying. A further demonstration was given in the Royal Botanic Gardens, Peradeniya, in July.

Visitors.—During the year Dr. L. L. Rutgers (Director of Agriculture, Java), Mr. F. G. Smith (Secretary, Rubber Growers' Association) and Mr. P. J. Burgess (Chairman,

London Advisory Committee), paid a visit to Ceylon and the opportunity was taken to discuss with these gentlemen matters of importance relating to research work on rubber.

PROGRESS OF WORK.

1.—ORGANISING SECRETARY.

(a) **Secretarial.**—Mr. J. Mitchell has continued his duties as General Secretary of the Research Scheme and as Secretary of the Executive and Technical Committees. Correspondence has again been heavy and there has been a considerable increase in the amount of work entailed in the distribution of Circulars, Bulletins, etc.

(b) **Visiting.**—In addition to the Secretarial work Mr. Mitchell has paid visits to 65 estates and has issued reports thereon to the Agents and to the Superintendents of the estates visited. Mr. Mitchell's report is attached and from this it will be noted that there has been a further improvement in the general condition of estates in Ceylon. Your Committee desires to emphasise that there are indications that Brown Bast is again on the increase, particularly in the drier districts of the Island.

2.—CHEMIST.

Mr. T. E. H. O'Brien proceeded on home leave on June 10th and resumed duties again on December 15th. The following is extracted from his attached report:—

(a) **Smoking Experiments.**—The experiments on the smoking of sheet rubber in relation to mould prevention were completed at the end of 1925 and the full report therein has been issued as Research Scheme Bulletin No. 42.

In addition, a report was prepared at the request of the Director of Agriculture on the construction of smoke-houses for small estates and this has been issued as Research Scheme Bulletin No. 44.

Preliminary experiments have been carried out with a view to the elimination of firewood as a heating medium in smoke-houses and these experiments are being continued.

(b) **Paranitrophenol.**—The results of experiments with this substance have shown that it is satisfactory as a mould preventive and a definite recommendation to use it has been issued.

(c) **Formic Acid.**—A few complaints of streakiness and discoloration have been received following on the use of this acid but it is considered that other factors may have operated to cause these defects. It is proposed to make a close enquiry into this matter during 1927.

(d) **Glass Hydrometers.**—Arrangements have been completed for the importation of the glass hydrometer designed by Mr. O'Brien and it is anticipated that supplies will be available in the early part of 1927.

(e) **Bordeaux Mixture.**—Experiments were carried out to determine if the contamination of latex with Bordeaux Mixture would prove detrimental to the rubber. It was found that the addition of very small amounts of copper leads to deterioration and it is necessary to urge that extreme care be taken to ensure that all copper compounds and mixtures be

kept away from factories and that no utensil used in the making or transport of Bordeaux Mixture should be used for the collection of latex. These experiments were made in the laboratory and it is not presumed that any appreciable contamination takes place during spraying operations. Arrangements have, however, been made for samples to be prepared on South Indian Estates during spraying operations so that further tests can be carried out.

(f) **Visits to Works.**—While in England Mr. O'Brien paid visits to various rubber manufacturing works and to the laboratories of various research institutions.

3.—PHYSIOLOGICAL BOTANIST.

Mr. R. A. Taylor continued his duties as Physiological Botanist and in addition, during the absence of the Chemist (on leave), and the Mycologist (resigned), dealt with the material and correspondence received at the laboratories.

(a) **Manuring Experiment.**—The application of the series of manures in the experiment being carried out on Arapolakande Estate was completed in February. Measurements of all the trees in the blocks have been taken, bark samples examined, and yield records kept. In addition, soil samples have been taken and will be analysed when a suitable opportunity arises.

(b) **Budding of Rubber.**—Yield records of high yielding trees on a large number of estates in different districts of the Island have been received and bark samples from these trees examined and classified. This work is being continued and correlation tables are being prepared with the view to determining the important factors governing yield. The best material available is to be used for the supply of budwood to the Research Scheme Experiment Station.

A demonstration of the technique of budding of rubber was given at Peradeniya and a leaflet "Budding of Rubber on a Commercial Scale" was distributed. Instruction and information has been given to a large number of applicants on all questions relating to this subject.

(c) **Experiment Station, Nivitigalakele.**—Mr. Taylor has been placed in charge of the Research Scheme Experiment Station which is being developed. The area opened has been planted with material of known parentage from Heneratgoda and Peradeniya. Nurseries have been established from seed of known high yielders for the purpose of extensions to be carried out during 1927.

(d) **Relationship between Yield and other Characters.**—A study has been made of the various characters of the progeny of the Heneratgoda No. 2 tree from data supplied by the Department of Agriculture from the Experiment Station, Peradeniya. The results have been embodied in Research Scheme Bulletin No. 43 and show (1) that yield is an inherent quality of the tree (2) that a latex vessel row count is of more value in connection with "thinning out" operations with old trees than with very young ones and (3) that girth and cortex thickness are intimately related.

4.—MYCOLOGIST.

Mr. R. H. Stoughton-Harris resigned his appointment on September 2nd, for domestic reasons and the attached report has been prepared from the progress reports issued by him up to that time.

(a) **Bark Rot.**—The experiments which were started in 1925 to test the efficiency of various disinfectants were continued. In addition to the proprietary disinfectants others of a special nature were tested and while no final conclusions could be framed there are indications that disinfectants incorporated into a non-soluble base are likely to prove more satisfactory than the water-soluble disinfectants.

A mycological study of *Phytophthora Faberi* in artificial culture was made and a summary of the results was given in the 3rd Quarterly Circular for 1926.

(b) **Pollarding Experiment.**—This experiment was continued and the results were published in the 3rd Quarterly Circular for 1926. These indicate that pollarding of rubber trees is of no value against the attacks of secondary leaf-fall and is attended by such other unsatisfactory results that the practice is not to be recommended.

(c) **Manuring for Secondary Leaf-fall.**—All indications pointed to a definite improvement in the foliage cover as a result of manuring with Nitrate of Soda.

(d) **Spraying.**—Mr. Harris visited South India during March to obtain first-hand information on the practice of spraying of rubber and on his return carried out a series of demonstrations in the Ratnapura, Kelani Valley, and Katutara Districts and at the Royal Botanic Gardens, Peradeniya. These demonstrations were largely attended by planters in the respective districts. A leaflet "The Spraying of Rubber Trees as a Means of Control of Secondary Leaf-fall" was prepared for distribution.

Research Work at the Imperial Institute. A full report on the work carried out at the Imperial Institute is attached.

The London Advisory Committee has provided the following Reports:—

(a) The Development of Mould on smoked sheet.

(b) The effect of Adding Glue to Latex preserved with Caustic Soda—Vulcanising and Ageing Tests.

(Rubber Research Scheme Quarterly Circular, No. 3, 1926.)

(c) The Effect on Plasticity of Different Methods of Drying Sheet Rubber.

(Rubber Research Scheme Quarterly Circular, No. 3, 1926.)

(d) The Effect produced on rubber by adding Bordeaux Mixture to the Latex.

(Rubber Research Scheme Quarterly Circular, No. 4, 1926.)

(e) The Effect of Paranitrophenol on Plasticity, Vulcanising and Ageing properties of Blanket Crepe.

(Rubber Research Scheme Quarterly Circular, No. 4, 1926.)

The principal problems dealt with during the year were the variations in the plasticity of raw, masticated, and mixed rubbers, and the effects of preparation on the deterioration which occurs in the physical properties of vulcanised rubber on ageing.

Suitable methods of testing have been established and standardised plasticity and "artificial ageing" tests are now made whenever possible on all samples received for report on their quality.

The tests have revealed the fact that the products of different estates show marked variation in plasticity and ageing properties.

It has been found that the non-caoutchouc substances (serum substances) in latex have an important influence on ageing properties and an extensive series of investigations into this matter is being carried out.

PUBLICATIONS.

Rubber Research Scheme Bulletins.—The following Research Scheme Bulletins have been issued during the year:—

- No. 40. "The Vulcanising and Mechanical Properties of Wet Blanket Crepe and Wet Rolled Sheet."
- No. 41. "First Interim Report on Artificial Ageing Tests on Plantation Rubber."
- No. 42. "On the Smoking of Sheet Rubber in relation to Mould Prevention."
- No. 43. "The Inter-Relationship of Yield and the various Vegetative Characters in *Hevea Brasiliensis*."
- No. 44. "The Construction of Smoke Houses for small Rubber Estates."

Rubber Research Scheme Quarterly Circulars.—Circulars dealing with questions of current interest to the rubber planting industry have been published at quarterly intervals. The articles "The Spraying of Rubber Trees as a Means of Control of Secondary Leaf-fall" and "The Budding of Rubber on a Commercial Scale" have been reprinted as leaflets for more general distribution.

Rubber Growers' Association Bulletins.—All the Bulletins issued by the Rubber Growers' Association during 1926 have been received and issued to those estates which do not receive them direct from London.

The thanks of the Rubber Research Scheme are due to the Chamber of Commerce, Colombo, for the free use of their rooms for the various Meetings of the Committees of the Research Scheme.

Adopted by the Executive Committee at its Meeting held in Colombo on January 21st, 1927.

(Signed) F. A. STOCKDALE,
Chairman,
Executive Committee,
Rubber Research Scheme (Ceylon).

RUBBER RESEARCH SCHEME,
PERADENIYA,
19th January, 1927.

ORGANISING SECRETARY'S REPORT ON VISITS TO ESTATES.

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Tours of estates situated in all the rubber growing districts have been carried out and visits have been paid to 65 estates on the list of Subscribers to the Rubber Research Scheme. The characteristic symptoms of the various diseases met with have been carefully described and methods of treatment fully demonstrated for the benefit of the staff on each estate. In addition, the various problems connected with the cultivation of rubber and of manufacture have been enquired into and suggestions made for dealing with these. In all cases a report has been furnished for the general information of the Superintendent, Agents and Directors of the Company concerned.

The following comments indicate the conclusions arrived at as a result of these visits and represent the writer's opinion of the general condition of rubber estates in Ceylon at the present time.

DISEASES.

1. **Fomes lignosus.**—Treatment of this disease has been continued on the lines advised during the past four years and has proved uniformly successful. Every estate which has been visited can now be said to have this disease completely under control and there seems no reason to anticipate any adverse change in this position.

2. **Fomes lamaoensis (Brown Root Disease).**—As in previous years this disease has been met with on most of the estates visited but with one or two exceptions has caused very little loss. It is considered that the position in regard to this disease is quite normal.

3. **Ustulina zonata.**—This disease has been observed on all estates visited. The practice of cleaning up the base of the tree by removal of accumulations of earth scrap has led to the discovery of many early developments. It is advised that this practice be more widely adopted.

Very few estates have adopted the method of filling the cavities produced by this disease which was advised by the Mycologist to the Scheme in Quarterly Circular No. 4, 1925, but much good work in this direction has been done on certain estates. This matter is worthy of more attention from Estate Superintendents.

4. **Poria hypobrunnea.**—This disease has been very rarely met with and it would not appear to be of serious consequence on any Ceylon estates.

5. **Sphaerostilbe repens.**—There has been a marked reduction in the number of cases of this disease recorded by estates and observed by the writer during his inspections. There seems to be a fairly close connection between the frequency of flooding and the appearance of this disease on those estates particularly concerned.

6. **Xylaria Thwaitesii.**—This little known disease has now been brought under complete control on the estate where it has previously been in evidence and it has not been observed elsewhere nor have any reports of its occurrence been received.

7. **Rhizoctonia bataticola.** --In view of the reports now being issued by Dr. W. Small (Mycologist, Department of Agriculture) concerning the occurrence of this disease on rubber roots it is proposed to pay close attention to the possible occurrence of this disease under the conditions described by Dr. Small. Superintendents should make themselves acquainted with the symptoms of this disease and send samples of the small roots of diseased trees for examination.

8. **Secondary Leaf-fall and Pod Disease.** --Outbreaks of this disease occurred in the Kalutara and Kelani Valley Districts and a considerable amount of defoliation took place. Nevertheless, there are undoubted indications that the revival of manuring, consequent on the improved prospects for rubber cultivation, has led to improvement in many areas and there seems reason to anticipate that the improvement will, judging by the results of the Gallawatte experiment, be cumulative.

Prior to the onset of the S. W. Monsoon spraying demonstrations were given by the Rubber Research Scheme in each of the planting districts and some estates carried out a certain amount of spraying on the lines indicated at these demonstrations. The reports which have been received from these estates are uniformly disappointing as to the results obtained. Again, there appears to be a consensus of opinion that spraying under Ceylon conditions is not economically practicable.

9. **Black Stripe Canker or Bark Rot.** --This disease is now being well controlled on most estates but a few still continue to suffer in spite of the precautions taken by them. As a result of the research work carried out by the Mycologist to the Research Scheme it has now been considered advisable to recommend the application of Cargillineum Mixture every ten days to that portion of the bark which had been tapped in that period, in addition to the preventive painting with water soluble disinfectants after every tapping. Where the disease has developed it is advisable to cease tapping for one or two months according to weather conditions. For the first time during the past four years this disease has been reported from estates in the Uva District, following on the N. E. Monsoon of 1925.

10. **Patch or Claret Coloured Canker.** --The position with regard to this disease is greatly improved on all estates visited. This disease is steadily falling into the category of minor diseases on Ceylon estates.

11. **Die-back (*Botryodiplodia theobromae*).** --A few cases of this disease have been observed and reported but very little damage has been caused.

12. **Pink Disease (*Corticium Salmonicolor*).** --No cases of this disease have been observed or reported during the year.

13. **Brown Bast.** --There are very definite indications that this disease is again on the increase particularly in the Kurunegala, Matale, and Uva Districts (Dry Districts) and a large percentage of cases has been observed on some estates. It is gratifying to report, however, that good results are being obtained from the treatment advised and there is no reason why the treatment should not be adopted on all estates. Many of the difficulties connected with diagnosis and treatment have been overcome and there is abundant evidence to show that intelligent coolies can be trained to do excellent work. A close enquiry has been made into the question of the time which must elapse between treatment and renewal

of tapping operations. In the majority of cases this period is four years and except under very adverse conditions of climate and soil this period is not likely to be exceeded by more than six to twelve months.

14. **Oidium leaf-fall.**—Only one estate has reported a recurrence of this disease during the year.

GENERAL PROBLEMS.

1. **Manufacture.**—A high standard of manufacture has been reached and remarkably few complaints have been received during the year. Though two complaints were received of streakiness in smoked sheet following on the adoption of Formic Acid as a coagulant this acid is proving quite satisfactory.

Paranitrophenol has proved entirely satisfactory in eliminating mould and experiments which have been made show that it can now be used to clean up sheet which has already become mouldy.

“ Rust ” on sheet rubber is now one of the rarest occurrences in Ceylon factories.

2. **Budding of Rubber.**—Following on the visit of Messrs. H. W. Roy Bertrand and C. E. A. Dias to the Dutch East Indies and the addresses given by Mr. Bertrand there has been a strong revival of interest in this subject. Attention has been drawn to the importance of this subject in each Annual Report issued by the Rubber Research Scheme since 1921 and it is to be hoped that the interest which has again been raised in the subject will be maintained and that all estates will co-operate with the Scheme in its endeavours to bring about an improvement in the position.

3. **Manuring.**—The subject of manuring of rubber is claiming considerable attention owing to the need for improving the condition of the majority of Ceylon estates. Numerous carefully devised manurial experiments have been carried out which have given no indication of improved yields though there was good reason to believe that an improvement in the general condition of the trees had resulted therefrom. A further series of experiments is being carried out by the Research Scheme on Arapolakande Estate and every possible care is being taken to ensure the accuracy of the records. Until the results of these experiments are available a cautious attitude should be adopted.

4. **Cover Crops.**—The value of cover crops as a means of preventing soil erosion and for the purpose of improving the general condition of the soil is now generally recognised. Excellent covers of *Vigna oligosperma* have been established on many estates and *Tephrosia Candida* (Boga Medelloa) continues to give satisfactory results. No other covers have secured the favour accorded to these two cover crops.

(Signed) J. MITCHELL,

Organising Secretary.

RUBBER RESEARCH SCHEME (CEYLON),

PERADENIYA,

2nd February, 1927.

CHEMIST'S REPORT FOR 1926.

The writer proceeded to England on furlough on June 10th, returning to Ceylon on December 15th. During his absence chemical work was held in abeyance and the following report refers mainly to work carried out in the earlier part of the year.

1. SMOKING OF SHEET RUBBER.

Experiments on the smoking of sheet rubber in relation to mould prevention were concluded at the end of 1925. A report on the experiments was compiled and has now been published as Bulletin No. 42 of the Research Scheme.

It was concluded that under normal estate conditions mould on sheet rubber can be prevented by attention to certain points during manufacture, but that no method of smoking renders sheet entirely immune to mould. In cases where mould could not be prevented by other means it was recommended that the use of para nitro phenol should be adopted.

At the request of the Director of Agriculture a report was prepared on "The construction of smokehouses for small rubber estates." This has been published as Bulletin No. 44 of the Research Scheme and Bulletin No. 79 of the Department of Agriculture, Ceylon.

In the series of small scale experiments with "uncombusted" smoke, the two problems of heat and smoke production in the smokehouse were dealt with separately. It is now proposed to repeat the experiments on a larger scale and it is hoped that they may point the way to appreciable economies in fuel consumption, and possibly to the elimination of fire-wood as a *heating* medium in smokehouses.

Considerable interest is being taken in London in the possibility of entirely eliminating the smoking process in sheet manufacture. It is suggested that sheet should be dried in hot air after treatment with para nitro phenol to prevent mould. Experiments on these lines will also be carried out.

Tests were made with a view to producing sheet having the appearance and properties of smoked sheet, without the use of wood smoke. Sheet of satisfactory appearance was prepared and a sample was forwarded to the Imperial Institute for vulcanisation tests. The results were not completely satisfactory but justify further experiments.

2. PARA NITRO PHENOL AS A MOULD PREVENTIVE.

Tests with para nitro phenol have been carried out by numerous Estate Superintendents and on certain estates its use has become standard practice. A number of sample sheets were received at the laboratories and were tested for resistance to mould.

In certain cases the sheets were completely resistant to mould, whilst in others mould developed freely indicating that the treatment with p.n.p. had not been carried out properly.

When soaking sheets in p. n. p. solution it is essential that every part of each sheet should come in contact with the solution, otherwise it cannot be expected that the sheets

will be protected against mould. Factory tests were carried out by the writer to develop a procedure which would ensure this, and the results are given in "Notes on para nitro phenol" published in the 1st Quarterly Circular for 1926.

Para nitro phenol dissolves with difficulty in cold water but is readily soluble in boiling water. The solution required for treatment of sheets in a 50 gallon jar can conveniently be prepared by dissolving $6\frac{1}{2}$ ounces of the chemical in half a bucket of boiling water. This solution is strained through muslin into a jar containing 38 gallons of water.

Arrangements were made by the Research Scheme that a stock of the chemical should be held by the Colombo Commercial Co., Ltd., and this has been available for some months.

3. FORMIC ACID AS A COAGULANT.

During the year the use of formic acid as a coagulant has been standardised on a number of estates. Though complaints from one or two estates have been received that streaky or dark coloured crepe resulted from the use of this acid all other estates report satisfactory results and consequently it would appear that other factors were probably responsible for the defects reported.

4. GLASS HYDROMETERS FOR LATEX.

A report on factory and laboratory tests with the experimental glass hydrometer for latex was published in the 1st Quarterly Circular for 1926.

Latex from 7 different plots was tested daily by means of the glass hydrometer and a brass metrolac, the readings being compared with the actual rubber content as determined by coagulation. The glass hydrometer over a period of 7 months showed an error of +4.4% compared with +15.9% for a new brass metrolac.

It was shown that a suitable correction should be applied to the figures if the best results are to be obtained, the simplest plan being to use the error of one month's results as the correction for the following month's readings. On this basis both the glass hydrometer and the brass metrolac showed an error of + 0.5% over a period of 7 months.

It was decided by the Technical Committee that the interest shown by planters in the hydrometer was sufficient to justify it being placed on the market, and arrangements have been made for Messrs. Walker, Sons & Co., Ltd., of Colombo to carry a stock of the instruments.

Whilst on furlough several personal visits were made to Messrs. Dring and Fage, Hydrometer Manufacturers, and they have now constructed to Research Scheme specification a hydrometer which is considerably more robust than those previously tested and which is considered to be suitable for estate use. It is hoped that a supply of these hydrometers will be available early in 1927.

5. MINERAL CONSTITUENTS OF LATEX.

The preliminary stages of an investigation of the effect of heavy tapping on the mineral constituents of latex were completed, but as the ash was derived from the latex of 2

individual trees only it has been decided to carry out further work on the subject before publishing the results.

6. EFFECT OF BORDEAUX MIXTURE ON RUBBER.

In continuation of the experiments carried out last year, a set of samples was prepared in which specific quantities of Bordeaux Mixture were added to latex before coagulation. The samples were forwarded to the Imperial Institute for examination and have now been reported on. To summarise the results it appears that the presence of an amount of Bordeaux Mixture corresponding to 1 part of copper in 100,000 of rubber causes marked deterioration in the ageing properties of the vulcanised rubber, and quantities as small as 1 part in 1,000,000 may have an appreciable effect.

It should be emphasised that these results refer to laboratory samples in which copper was purposely added to the latex. It is not suggested that rubber from sprayed areas is contaminated with copper.

The figures indicate the extreme care which should be exercised in dealing with copper salts on rubber estates. It is advisable that they should be kept away from the factory and that all utensils used in handling Bordeaux Mixture should be plainly marked to ensure that they are not inadvertently used for latex.

7. VISITS IN ENGLAND.

Whilst in England visits were paid to the factories of Messrs. The North British Rubber Company, Ltd., and Messrs. Dunlops, Ltd. The manufacture of various articles such as tyres, shoes, golf balls, hot water bottles, vulcanite combs, etc., was followed with great interest.

As regards raw rubber the impression was gained that variability in rate of vulcanisation of rubber from different estates has lost much of its significance since the introduction of accelerators. On the other hand variability of plasticity, *i.e.*, variation in the amount of milling required to bring different batches of rubber to a suitable consistency for manufacturing processes, continues to cause much inconvenience.

Wood splinters and other impurities in rubber continue to give trouble and the opinion was expressed that much of this could be avoided by lining the chests with rubber before packing. This entails no extra expense to the producer and it is hoped that the practice will be adopted more widely than at present.

The works of Messrs. J. Robinson & Co., Ltd., Manufacturers of Rubber Plantation machinery were visited. It was mentioned there that Ceylon is the only country which continues to specify even-speed rolls for smooth crepe rollers. Those for Malaya are usually provided with a speed ratio of 17: 28 between the 2 rolls, which has been shown to produce a more even crepe. (*See* "Blanket crepe and thin crepe" R. R. S. 4th Quarterly Circular for 1925, p. 3.)

Visits were also made to the Rubber Research Scheme Laboratories at the Imperial Institute, the Laboratories of the Research Association of British Rubber and Tyre Manufacturers, and to the Netherland Government Rubber Institute at Delft. Variability

in plasticity of Plantation rubber was again mentioned as one of the most important problems to be investigated by producers. Interest is also being taken in the improvement of ageing properties of vulcanised rubber. Ageing properties have already been considerably improved by the use of various accelerators.

It is now generally agreed that Hopkinson Sprayed rubber is at least equal if not superior to ordinary plantation rubber as judged by vulcanisation tests. The latest sample examined at the Imperial Institute was reported to be superior to sheet and crepe rubber as regards plasticity, rate of vulcanisation, and maintenance of tensile strength during ageing. At present the market for this type of rubber is restricted to one firm but if a more general demand arose, it would seem that adoption of this process of manufacture would go far to solve the problem of variability of plasticity, apart from the economy which is claimed for it.

8. REPORTS PUBLISHED DURING 1926.

"The Smoking of Sheet Rubber in relation to Mould Prevention."—*R. R. S. Bulletin* No. 42.

"The Construction of Smokehouses for small Rubber Estates."—*R. R. S. Bulletin* No. 44.

"Some points in connection with the manufacture of Rubber."—*Tropical Agriculturist*, April—May, 1926.

"Glass hydrometers for latex."—*R. R. S. 1st Quarterly Circular*, 1926.

"Hydrometers for Formic Acid."—*R. R. S. 1st Quarterly Circular*, 1926.

"Notes on para nitro phenol."—*R. R. S. 1st Quarterly Circular*, 1926.

9. SUMMARY OF WEATHER RECORDS AT CULLODEN LABORATORIES.

	1926.	1925.
Rainfall ...	161.2 inches	190.9 inches
Highest Monthly rainfall ...	33.815 inches (May)	30.24 „ (October)
Highest daily rainfall ...	8.305 „ (15-5-26)	8.24 „ (8-11-25)
Highest shade temperature recorded (day)	95.7° F. (22-3-26)	93.2° F. (24-9-25)
Lowest shade temperature recorded (day)	76.8° F. (7-9-26)	74.9° F. (29-9-25)
„ „ „ „ (night)	66.6° F. (19-1-26)	65.5° F. (21-1-25)

(Signed) T. E. H. O'BRIEN,
Chemist,
Rubber Research Scheme.

RESEARCH LABORATORIES,
CULLODEN ESTATE,
NEBODA.
3rd January, 1927.

PHYSIOLOGICAL BOTANIST'S REPORT FOR 1926.

1. BUDDING AND SELECTION.

The most important part of the year's work has been that connected with the propagation and selection of high-yielding strains of trees. In the past, careful attention to cultivation, manuring and harvesting have ensured to estates a satisfactory return per acre, but with more planting and the increasing costs of labour, some other means has now to be sought. The only apparent method of doing this is by increasing the yield of Rubber obtained from the trees, and the first steps towards this end have been taken.

The interest in this work has now become fairly general, and the number of trees in Ceylon whose yield record is known has increased considerably during 1926. The interest in budding as a means of producing better trees has also greatly increased and most estates with any reserve of land are making arrangements to have new clearings budded.

In this connection several demonstrations of the methods of budding have been given and numerous estates have been visited and advice and instruction given. A pamphlet on Budding was also prepared for distribution at demonstrations.

2. EXPERIMENT STATION.

At the beginning of the year a small tract of jungle land, 50 acres in extent, was granted to the Rubber Research Scheme to form the nucleus of an Experiment Station. Part of this, about 13 acres, was opened early in the year and has now been planted with seedlings, the progeny of known trees. These seedlings are to be used as stocks for the testing out of bud-mother trees. The origin of every seedling is known and it is hoped that all will be budded during 1927. The effect of the stock on the resulting tree is receiving careful study, and when budding is actually carried out the greatest possible number of combinations of stock and scion will be made.

The area opened has been planted on the contour system with rows in one direction and the whole block has been platform terraced. The rows are 18 feet apart and the terraces average 20 feet apart, giving about 120 trees to the acre. The platforms slope back into the hill at about 1 in 5 or 1 in 6. No minor roads have so far been found necessary and no drains; the back of the platform acts as a silt-pit-drain and there is no run-off, all water percolating away through the soil.

This conservation of water is probably not of so much value in the Kalutara district as in places where the dry season is more extensive, but, as there is no great movement of water over the surface the loss of top soil is prevented. Soil wash is also being prevented by the growing of cover crops between the terraces. *Vigna Oligosperma* has been planted over a large portion of the clearing and *Tephrosia Candida* and *Clitoria cadjanifolia* have been sown along the edges of the platforms to help to consolidate the excavated soil.

A nursery has been laid out and now contains sufficient selected plants to plant up a further 20 acres in 1927. These seedlings will if possible be budded in the nursery.

The work at present in hand also includes the establishment of budwood nurseries and the preparation of material for the planting up several isolated seed gardens.

A bungalow has been built for the Conductor and temporary lines have been erected. Permanent lines are in the course of construction.

A certain amount of difficulty was encountered in obtaining labour for the new clearing work, but this has now been overcome. Owing to the excessive charges made by the Contractors the felling of the 20 acres for the 1927 planting has been done by estate labour.

3. STUDY OF CHARACTERS OF HIGH-YIELDING TREES.

In connection with plant breeding a considerable amount of preliminary work has been done on the relationship between the Yield of a tree and the various measurable vegetative characters, *e.g.*, girth, thickness of cortex and number of latex-vessel-rows. The earlier work has been published in Rubber Research Scheme Bulletin 43 (Bull. 77 of Department of Agriculture, Ceylon). In this and previous papers on the same subject the correlations given have been those obtained by the direct comparison of Yield and the other characters individually, and no account has been taken of possible interrelationships between such characters as girth and thickness of cortex, thickness of cortex and number of latex vessel rows, etc. It is therefore possible that, in these figures, the effect of girth on Yield is reflected in the coefficient of correlation between Yield and thickness of cortex as well as in that between yield and girth, etc. The method of Partial Correlation has now been applied and figures have been obtained showing the real relationship between Yield and each of the characters, girth, thickness of cortex and number of latex vessel rows by eliminating the effect of any interrelationship between the latter. Calculations have been made from data obtained from trees of various ages.

The final object in this work is to discover some method of ascertaining the approximate value of a tree while it is still in the nursery stage. The importance of this will be seen when consideration is given to the large areas which would be required to plant up all the progeny of the mother trees studied and the reduced space which will be necessary if it is found possible to discard mediocre or poor trees while they are still in the nursery. The programme for 1927 includes the examination from this stand point of 500 one-year-old seedlings. Measurements are to be made on these annually until they reach tappable size and in this way it is hoped to discover what is the earliest age at which the value of a tree can be estimated. It is thought it will be possible to publish results in continuation of Bulletin 43 at an early date.

4. MANURING.

The Manuring experiment laid out during 1925 on Arapolakande Estate has been continued. The preliminary year's record of yields was obtained in February and the first application of manure was made then. There are 5 different treatments and 5 plots have been allotted to each giving a total of 25 plots. The treatments are Nitrate of Soda alone, Muriate of Potash alone, Ordinary Superphosphates alone, a mixture of the three, and controls. From an agricultural point of view all the plots have been treated alike, controls as well as manured plots being forked.

At the time of application of manure bark samples were taken from every tree, one of normal bark and one from the previous year's tapping panel, and measurements of girth and length of cut were made. Latex vessel rows have been counted and the bark thickness recorded, and it is intended to make a study of the effects of the various manures on these characters as well as on girth and Yield.

During the course of bark examination several trees were found with very thick bark and with a large number of Latex Vessel Rows. These were examined from the point of view of suitability for use as Bud-mother trees but only one was finally selected. The others were found to be boundary trees growing on the edge of a paddy field and were not considered to be normal owing to the special conditions under which they were growing.

5. "CHANGE-OVER" TAPPING.

The experiment on the effect of periodic changing over the tapping cut from one side of the tree to the other has been continued. There are 4 blocks. On 2 of the blocks the cut is changed over in March and again in September, on the others no change is made until the cut has reached the bottom of the tree. Early in the year bark samples from all trees were taken and the renewal examined. There were found to be indications that the Change-Over had been beneficial from the point of view of bark renewal but the differences were not of sufficient magnitude to be considered statistically significant. The Yields from the Change-Over plots showed no increase, which could be attributed to the tapping system over those from the non-change over plots.

6. POLLARDING EXPERIMENT.

The Pollarding Experiment on Maddeggedera Estate which was conducted by the Mycologist was taken over on his departure.

This was an attempt to produce by pollarding a type of tree which, if not immune from leaf-fall, would lend itself to easy spraying and the experiment is still in progress. It has been found that the removal of all overhead cover has caused large sun cracks on all exposed sideroots, and as a number of trees are now being pollarded in Ceylon for the production of budwood, a communique has been issued to the Press suggesting that before pruning all sideroots should be covered.

7. OTHER WORK.

During the absence of the Chemist and Mycologist correspondence in connection with these departments has been attended to. A number of Metrolacs have been standardised and a test was carried out on the efficiency of Paranitrophenol in preventing a recurrence of mould on Sheet Rubber which had already become affected. This proved successful.

A fairly large number of bark samples received from estates have been examined and the method of examination has been demonstrated to several interested persons who have called at the Laboratories.

(Signed) R. A. TAYLOR,
Physiological Botanist.

RESEARCH LABORATORIES,
CULLODEN ESTATE,
NEBODA.

1-2-1927.

MYCOLOGIST'S REPORT FOR 1926.

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Mr. R. H. Stoughton-Harris resigned his appointment as Mycologist to the Rubber Research Scheme on September 2nd, 1926, and the following report is drawn up from data given in Mr. Harris' Monthly Progress Reports:—

1. **Inhibition Experiments.**—The experiments to ascertain the power of disinfectants to inhibit the growth of *Phytophthora Faberi* in artificial cultures which were started in 1925 were continued and in addition to those referred to in the 1925 Report the following disinfectants were examined:—

Di-nitrophenol	Ortho-cresol
Special samples containing definite	Meta-cresol
percentages of Tar Acids	Para-cresol

Each disinfectant was used in a series of concentrations in a medium suitable for the growth of *Phytophthora Faberi*. The concentration at which no growth occurred has been given the term "Effective Inhibiting Concentration" (abbreviated to "E. I. C.") and the following results recorded for the above disinfectants:—

			E. I. C.
Di-nitrophenol	...	...	.005%
Para-cresol	...	...	.04%
Meta-cresol	...	...	.06%
Ortho-cresol	...	...	.07%
25% Tar Acids	...	...	.10%
15% " "	...	...	.15%
5% " "	...	...	.25%

These experiments demonstrate the fact that the cresols and higher concentrations of tar acid derivatives have a greater fungicidal power than the various proprietary disinfectants at present being sold. It would appear that further work on this subject is desirable with a view to establishing a formula giving the best possible results under all conditions.

2. **Disinfectant Experiments for the Control of Bark Rot.**—The experiments carried out during 1925 were repeated and were finally reported on in July. While no conclusive results were obtained there were indications that the best results were secured in the prevention of bark rot from the use of the non-water soluble disinfectants. It is recommended that Cargillineum Mixture be applied to the tapping surface every ten days in addition to the application of water soluble disinfectants after each tapping. Cargillineum Mixture cannot be applied in wet weather.

3. **Physiology of *Phytophthora Faberi*.**—Further work was done on the influence of the reaction and the concentration of the medium on the growth of *Phytophthora Faberi* in artificial culture and an account of this work was published in the 3rd Quarterly Circular for 1926. It was found that in strongly acid media the growth of the fungus diminished.

4. **Pollarding Experiment.**—Observations on the effect of pollarding trees were continued and the results published in the 3rd Quarterly Circular for 1926. It would appear (1) that a pronounced reduction in yield takes place and showed no improvement after 9 months from the date of Pollarding, (2) that pollarding does not prevent secondary leaf-fall, (3) that the large wounds caused by pollarding do not heal and there is consequently a dying back of the branch or stem which has been cut and (4) that unless the roots of such trees are covered prior to pollarding severe sun-cracking of the exposed laterals takes place.

5. **Manuring Experiment.**—Records from the Manuring Experiment on Gallawatte Estate up to the end of the 1925 tapping season were analysed. At that time the experiment had been in progress for 3 years and while there was an obvious improvement in the general appearance and condition of the trees throughout the manured plots there was no significant improvement in the yield of the manured plots when compared with the unmanured controls.

6. **Spraying Demonstrations.**—During March a visit was paid to South India to enquire into the subject of spraying for the control of secondary leaf-fall. A report on this visit was included in the 2nd Quarterly Circular for 1926 and a special article "The Spraying of Rubber Trees as a means of Control of Secondary leaf-fall" was published in the 1st Quarterly Circular for 1926. Following on this visit spraying demonstrations were given in the Ratnapura, Kelani Valley, and Kalutara Districts and at the Royal Botanic Gardens, Peradeniya. These demonstrations were largely attended by planters in the respective districts. Several estates subsequently carried out spraying operations but the results have proved disappointing.

7. **Reports.**—The following special reports were prepared by Mr. Harris prior to leaving Ceylon and will, in due course, be published as Rubber Research Scheme Bulletins:—

"On the Efficiency of Disinfectants and Fungicides."

"Experiments on the Control of Bark Rot by disinfectants."

The following reports by Mr. Harris have appeared in the Quarterly Circulars during 1926:—

"The Spraying of Rubber Trees as a means of Control of Secondary leaf-fall."

"Notes on Spraying of Rubber in Ceylon."

"Report on visit to South India."

"Effect of pollarding Rubber Trees."

"The influence of the reaction and the concentration of the medium on the growth of *Phytophthora Faberi* in Artificial Culture."

RUBBER RESEARCH SCHEME (CEYLON),

PERADENIYA,

3rd February, 1927.

REPORT OF LONDON ADVISORY COMMITTEE FOR 1926.

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London Advisory Committee.—Towards the end of the year Mr. P. J. Burgess, the Chairman, left on a visit to the East. He attended a meeting of the Ceylon Committee at Colombo and discussed with the Members various questions connected with the Scheme. During his absence Sir Edward Rosling is acting as Chairman of the Committee and of the Technical Sub-Committee.

Mr. G. H. Masefield was appointed as a representative of Ceylon planting interests *vice* Mr. Gollidge resigned. On the resignation of Mr. Percy Rosling, Mr. W. C. Smith, F.I.R.I., of Callenders Cable and Construction Co., Ltd., was appointed as a representative of manufacturing interests.

Lt.-Col. J. Sealy Clarke was nominated by the Research Association of British Rubber and Tyre Manufacturers as their representative in place of Mr. A. Johnston.

Meetings of Committee.—Both the Committee and the Technical Sub-Committee held four meetings during the year. The Committee and Sub-Committee had the benefit of the assistance of Mr. W. Coombe and Lt.-Col. T. Y. Wright, members of the Ceylon Committee, and of Mr. T. E. H. O'Brien, B. Sc., A.I.C., Chemist in Ceylon, who attended the meetings whilst in this country. During his stay in England Mr. O'Brien discussed fully with the Staff in London and with members of the Committee several matters relating to the investigations in progress and his future programme of work. Arrangements were made for him to visit the factories of the Dunlop Rubber Co., Ltd., and the North British Rubber Co., Ltd., and also the laboratories of the Research Association of British Rubber and Tyre Manufacturers and the Netherland Government Rubber Institute, Delft. The Committee desire to record their appreciation of the valuable assistance rendered by the staff of these organisations in connection with the visits.

Finance.—As in previous years the Rubber Growers' Association's contribution of £2,000 to the Scheme was paid to the London Committee as a matter of convenience.

The expenditure incurred by the London Committee during the year was £2,431 17s. 10d., which included £187 16s. 0d. in respect of apparatus, etc., purchased on behalf of the Ceylon Committee. At 31st December, 1926, there was an unexpended balance in London of £368 14s. 7d.

Staff.—No alterations occurred in the Technical Staff which consists of Mr. G. Martin, B.Sc., A.I.C. (Superintendent), Mr. W. S. Davey, B.Sc., A.I.C., Mr. F. L. Elliott, F.I.C. and Mr. L. L. Stewart.

Investigations.—The principal problems dealt with during the year were the variations in the plasticity of raw, masticated and mixed rubbers, and the effects of methods of preparation on the deterioration which occurs in the physical properties of vulcanised rubber on ageing.

Since 1925 considerable progress has been made in connection with both these subjects.

The preliminary investigations to establish suitable methods of testing which have been in progress for some time have been completed and standardised plasticity and "artificial ageing" tests are now made wherever possible on all samples received for report on their quality.

In connection with the work on plasticity, it is of interest that the products of different estates have shown marked variation, and it is accordingly proposed to devote special attention in 1927 to a study of the cause of this inequality.

In the course of the detailed investigation of the ageing properties of different forms of plantation rubber after vulcanisation a number of interesting points have been observed, the most important of which is the value of the serum substances. The whole of the results are being reviewed in a paper which Mr. Martin is reading before the London Section of the Institution of the Rubber Industry on the 10th January, 1927.

As in previous years tests have been made on a number of samples received in connection with the investigations carried out by the Technical Staff in Ceylon; further particulars of these and other investigations are given in the Appendix to this report.

The following reports were forwarded to Ceylon during the year:—

The Development of Mould on Smoked Sheet.

The Effect of Adding Glue to Latex Preserved with Caustic Soda—Vulcanising and Ageing Tests (Research Scheme Quarterly Circular No. 3, 1926).

The Effect on Plasticity of Different Methods of Drying Sheet Rubber (Research Scheme Quarterly Circular No. 3, 1926).

The Effect Produced on Rubber of Adding Bordeaux Mixture to the Latex (Research Scheme Quarterly Circular, No. 4, 1926).

The Effect of Paranitrophenol on Plasticity. Vulcanising and Ageing Properties of Blanket Crepe (Research Scheme Quarterly Circular, No. 4, 1926.)

(Signed) EDWARD ROSLING,
Acting Chairman.

IMPERIAL INSTITUTE,
LONDON, S. W. 7.
January, 1927.

APPENDIX TO ANNUAL REPORT OF THE LONDON COMMITTEE FOR 1926.

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Summary of Principal Technical Work carried out during the year.

(1) **Plasticity of raw rubber.**—In continuation of the experiments carried out in 1925, special attention was given to the investigation of the variations in the plasticity of plantation rubber, and it was again necessary to devote a considerable amount of time to the methods of testing.

Previously, marked variations were frequently observed in the results given by repeat tests, but the difficulties, which were chiefly concerned with standardisation of the conditions of mastication and of mixing with sulphur, have now been overcome. Moreover as a result of experience gained during the year a number of improvements were effected in the extrusion machine employed for determining the rate at which the masticated and the mixed rubbers can be forced through a small orifice under constant load and temperature.

In addition, the investigations were extended to include tests with the Ira Williams plasticity press which was described in last year's report. The press has the advantage that, unlike the extrusion machine, it can be utilised for the examination of raw rubber as well as masticated and mixed rubber.

In tests on a large number of samples it was found that the extrusion machine is much more sensitive to differences in plasticity than the plasticity press. The results of tests made on different raw rubbers have not always varied in the same direction as those on the corresponding masticated and mixed samples. The plasticity of the unmasticated rubber cannot therefore be taken as a guide to the behaviour of the rubber in important factory operations, such as extruding and calendering.

Considerable time is required for the determination of the plasticity of each sample by the present method so that the number which can be dealt with is comparatively small. When sufficient experience has been gained it is proposed to review the whole question with a view to determining what modifications can be made in order to expedite the tests. The masticated rubber and the rubber-sulphur mixing give results which bear a close relation to one another, and it is hoped to be able to omit the tests on one of them. It may also be possible to discontinue regular testing by the plasticity press except in the case of the raw rubber.

In addition to the work on a variety of samples in connection with the development of the scheme of testing, series of samples were specially prepared in Ceylon at the request of the London Committee with the object of studying the effect of different factors in preparation on plasticity. In these experiments it was found that unsmoked sheet was less plastic than smoked sheet, that the temperature of drying was important and that different smoke houses yielded rubber with different plasticities. A number of modifications have

been made in the methods of testing since these experiments were completed, and it is hoped to repeat them during 1927. The results so far obtained with a series of crepe and smoked sheet from different estates indicate that considerable variation occurs in the plasticity of the rubber of different estates, and it is clear that the cause of this variation merits detailed examination. Opportunity was taken of the visit of the Chemist in Ceylon to this country to discuss proposals for further investigations in connection with this problem, and the Ceylon Committee are being asked to arrange for him to prepare further sets of samples on his return to the Island.

Determinations of plasticity have also been made in the case of most of the samples received in connection with the investigation of other questions.

(2) Ageing Properties of Vulcanised Rubber.—The detailed study of the behaviour of vulcanised plantation rubber on keeping, which was referred to in last year's report, has been continued. It was first necessary to establish a suitable method for carrying out artificial ageing tests. Full particulars of the system of testing finally adopted are given in Rubber Research Scheme Bulletin No. 41.

Some rubbers which showed little difference in mechanical properties shortly after vulcanisation were subsequently found to exhibit marked difference in tensile strength and elongation after artificially ageing for various periods. It has therefore been considered desirable to carry out ageing tests wherever possible on all samples received for report on their general quality.

The principal conclusion to be drawn from the work of the year is that rubbers which retain the most serum substances give the best results as regards the development and maintenance of tensile strength on ageing on a rubber-sulphur mixing. On the other hand these rubbers show the greatest decrease in stretch under load. Having regard to these striking differences it is proposed to make a similar investigation in a number of technical mixings.

Manufacturers state that fine hard Para is more suitable for thread and tape than plantation rubber and it is of special interest that the physical characters of a sample of this rubber changed more slowly on ageing in a rubber-sulphur mixing than those of any plantation rubbers examined. Comparative tests under tension and after treatment with caustic soda will shortly be made with a series of samples of fine hard Para and plantation rubber in order to ascertain whether the former has any real advantage in this branch of manufacture.

The results obtained with different forms of rubber suggested that the non-caoutchouc substances present are of importance in connection with ageing, and an extensive series of investigations is accordingly being carried out with (a) dry serum from preserved latex and (b) the acetone extracts of different forms of rubber. Considerable progress has already been made and it has been found that the ageing properties are markedly affected by changes in the non-caoutchouc constituents. There appears to be an "antioxidant" present in the

non-saponifiable portion of the acetone extract and also in the serum. The "antioxidant" in the serum is almost ineffective in the absence of the acetone-soluble constituents but is very powerful in their presence.

(3) **Extraction of rubber with ammonia.**—In the course of investigations on ageing properties it was found that rubber which had been extracted with ammonia gave poor results on ageing, due to the removal of some of the serum constituents. It was observed that the acidity of the acetone extract was not greatly reduced by treating the rubber with ammonia, and that ammonia extracted considerably less material from masticated rubber and from rubber extracted with acetone than from the raw rubber. Crepe was found to yield less ammonia extract than sheet. It is considered that these investigations may yield information not only concerning ageing but also on other points of interest and it is proposed to continue them during 1927.

(4) **Sprayed latex rubber.**—In view of the interest which is being displayed in the United States of America in sprayed latex rubber, it was decided to obtain a further quantity and to submit it to the plasticity and ageing tests which had been developed since the publication of the previous report on this rubber (*see* Bulletin of the Rubber Growers' Association, February, 1924, page 93).

Of the four samples examined three were much more plastic than estate grades of crepe and sheet but the fourth was distinctly less plastic. All the samples developed a better tensile strength on ageing than estate grades of crepe and sheet, and maintained their tensile strengths for a longer period. This is in agreement with the results referred to in paragraph 2 on the effect of serum substances on ageing properties. The elongation at a given load decreased very quickly on ageing and this might render the rubber unsuitable for some purposes. The investigation was still in progress at the close of the year.

(5) **The Effect of Low Temperature on the Physical Properties of Raw Rubber.**—Rubber becomes very hard and opaque on exposure to low temperature and it is stated that different plantation rubbers show considerable variation in the ease with which they soften on warming. In a series of preliminary experiments carried out with different forms of plantation rubber no differences were observed in the rate at which samples became hard and opaque on being maintained at 0°C or in the rates at which they "thawed" on warming. These experiments and the results obtained have been discussed with the Research Association of British Rubber and Tyre Manufacturers, who are also carrying out an investigation on this subject on somewhat different lines, and arrangements have been made for further tests to be conducted at the Institute next year.

(6) **Bordeaux Mixture.**—In continuation of a previous investigation of the effect on the rubber of spraying the tapping side of the trees with Bordeaux mixture (*see* report for 1925) a set of crepes containing known quantities of Bordeaux mixture in the latex were received from the Chemist in Ceylon. It was found that even as little as 0.00005 per cent. of copper in the raw rubber caused the ageing properties of the vulcanised product to deteriorate, and that the greater the amount of copper in the rubber the more quickly the rubber perished.

Other Investigations.—(a) Reports have also been made on investigations of a variety of samples received in connection with other experiments of the Chemist in Ceylon. The following is a summary of the more important conclusions:

1. The Use of Paranitrophenol had no important effect on the plasticity and ageing properties of vulcanised rubber.

2. A sample of crepe prepared with formic acid as a coagulant was slightly less plastic than one prepared with acetic acid. (As soon as ageing tests have been completed the question of further work on this subject will be considered.)

Tests have also been completed on several sets prepared in order to determine the effect of differences in estate practice on variability in time of cure. A report on this investigation was in preparation at the close of the year.

(b) The duplicate experiments referred to in previous reports in conjunction with Dr. de Vries on the subject of the standardisation of methods of testing rubber are still in progress.

A paper by Messrs. Martin and Davey on "The Effect on Mechanical Properties of the Formation of Colloidal Precipitates during Vulcanisation of Rubber" was published in the Journal of the Society of Chemical Industry, XLV., 1926, pp. 174 T—176 T.

Programme of Work.—The following programme of work for 1927 was approved by the Technical Sub-Committee.

(1) The extent and causes of variability of Ceylon plantation rubber in respect of (a) plasticity, (b) time of vulcanisation and mechanical properties in different mixings, (c) ageing.

(2) Developments in the rubber industry of direct interest to the planter, *e.g.*, (a) Sprayed Rubber, (b) Revertex.

(3) Possible differences between Fine Hard Para and plantation rubber which may account for the preference of manufacturers for the former for the manufacture of such articles as golf ball tape, elastic thread.

(4) The effect of the non-caoutchouc constituents of latex on the ageing of the raw and vulcanised product.

(5) The use of latex serum products.

(6) The behaviour of different samples of plantation rubber when successively exposed to temperatures about 0°C and 20°C.

Examinations will also be made of samples prepared in connection with investigations in progress in Ceylon, *e.g.*, (a) The use of paranitrophenol, (b) Spraying of trees with fungicides, (c) Methods of smoking and drying.

EDWARD ROSLING,
Acting Chairman.

IMPERIAL INSTITUTE,
LONDON, S. W. 7.
January, 1927.

APPENDIX No. 1.

LIST OF MEMBERS.**Members of Rubber Growers' Association.**

- | | |
|--|---|
| Aboyne-Clyde Rubber Estates of Ceylon, Ltd. | Imperial Ceylon Tea Estates, Ltd. |
| Alliance Tea Company of Ceylon, Ltd. | Kandy Rubber and Tea Estates, Ltd. |
| Alluta Rubber and Produce Co., Ltd. | Kelani Valley Rubber Estates, Ltd. |
| Amalgamated Tea Estates Co., Ltd. | Kepitigalla Rubber Estates, Ltd. |
| Anglo-American Direct Tea Trading Co., Ltd. | Kintyre Tea Estates Co., Ltd. |
| Anglo-Ceylon and General Estates Co., Ltd. | Knavesmire Estates Co., Ltd. |
| Associated Tea Estates of Ceylon, Ltd. | Kudaganga Rubber Co. (of Ceylon), Ltd. |
| Bandarapola Ceylon Co., Ltd. | Lanka Rubber Co., Ltd. |
| Beau Sejour Rubber Co., Ltd. | Lanka Plantations Co., Ltd. |
| Beverley Tea and Rubber Estates, Ltd. | Lavant Rubber and Tea Co., Ltd. |
| Caledonian (Ceylon) Tea and Rubber Estates, Ltd. | Lochnagar (Ceylon) Produce Co., Ltd. |
| Carolina Tea Company of Ceylon, Ltd. | Lowmont Estates Co., Ltd. |
| Central Province Ceylon Tea Co., Ltd. | Lunuva (Ceylon) Tea and Rubber Estates, Ltd. |
| Ceylon Consolidated Estates (1920), Ltd. | Mahawale Rubber and Tea Co., Ltd. |
| Ceylon (Para) Rubber Co., Ltd. | Mapalagama Rubber Estates, Ltd. |
| Ceylon Proprietary Tea Estates Co., Ltd. | Mirishena (Kalutara) Rubber Co., Ltd. |
| Ceylon Rubber Co., Ltd. | Monerakelle Rubber Estates, Ltd. |
| Ceylon Tea Plantations Co., Ltd. | Nagolle (Ceylon) Rubber and Tea Plantations, Ltd. |
| Ceylon Timber and Rubber Syndicate, Ltd. | Nahalma Tea Estates Co., Ltd. |
| Colombo-Commercial Co., Ltd. | Narangoda Rubber Co., Ltd. |
| Consolidated Estates Co., Ltd. | Nayabedde Estates Co., Ltd. |
| Consolidated Tea and Lands Co., Ltd. | Neboda (Ceylon) Rubber and Tea Estates, Ltd. |
| Dalkeith (Ceylon) Rubber Estates, Ltd. | Ouvah Ceylon Estates, Ltd. |
| Dangan Rubber Estates, Ltd. | Panagula Rubber Co., Ltd. |
| Deviturai Rubber and Tea Estates Co., Ltd. | Panawal Tea Co., Ltd. |
| Dickella (Ceylon) Rubber Estates, Ltd. | Panawatte Tea and Rubber Estates, Ltd. |
| Dimbula Valley (Ceylon) Tea Co., Ltd. | Pantiya Tea and Rubber Co., Ltd. |
| Doloswella Rubber and Tea Estates, Ltd. | Parambe Rubber and Tea Co. of Ceylon, Ltd. |
| Doone Vale (Ceylon) Rubber Co., Ltd. | Pelmadulla Rubber Co., Ltd. |
| Doranakande Rubber Estates, Ltd. | Pelmadulla Valley Tea and Rubber Co., Ltd. |
| Eastern Produce and Estates Co., Ltd. | Pimbura Rubber Co., Ltd. |
| East India and Ceylon Tea Co., Ltd. | Pindenioya Rubber and Tea Estates, Ltd. |
| Ederapolla Tea Co. of Ceylon, Ltd. | Pitakande Tea Co. of Ceylon, Ltd. |
| Elmshurst (Ceylon) Tea and Rubber Co., Ltd. | P. P. K. (Ceylon) Rubber Estates, Ltd. |
| Elston Estates Company of Ceylon, Ltd. | Ragalla Tea Estates, Ltd. |
| Frocester Estate Rubber Co., Ltd. | Remuna Rubber Co., Ltd. |
| Galaha Ceylon Tea Estates and Agency Co., Ltd. | Rosehaugh (Ceylon) Rubber Co., Ltd. |
| Galphele Tea and Rubber Estates, Ltd. | Rubber Estates of Bentota, Ltd. |
| General Ceylon Rubber and Tea Estates, Ltd. | Rubber Estates of Ceylon, Ltd. |
| Glen Rubber and Tea Co., Ltd. | Saffragam Rubber and Tea Co. of Ceylon, Ltd. |
| Glendon Rubber Co., Ltd. | St. George Rubber Estates, Ltd. |
| Gonagama Rubber Co. (Ceylon), Ltd. | Standard Tea Co. of Ceylon, Ltd. |
| Govinna Rubber Co., Ltd. | Sunnygama Co., Ltd. |
| Grand Central (Ceylon) Rubber Estates, Ltd. | Telbedde Ceylon Estates, Ltd. |
| Hanwella Rubber Estates, Ltd. | Tempo Tea and Rubber Co., Ltd. |
| Hewagam Rubber Co., Ltd. | The Ceylon (Bibile) Rubber Estates, Ltd. |
| Higgoda Rubber Estates, Ltd. | United Planters' Co. of Ceylon, Ltd. |
| Hingurugama Tea and Rubber Estates, Ltd. | Vogan Tea Co. of Ceylon, Ltd. |
| Honiton Rubber Co., Ltd. | Woodend (Kelani Valley Ceylon) Rubber and Tea Co., Ltd. |
| Hunasgeria Tea Co., Ltd. | Yataderiya Rubber and Tea Co., Ltd. |
| Igalkande Rubber and Tea Estates, Ltd. | Yatiantota Ceylon Tea Co., Ltd. |

LOCAL SUBSCRIBERS.

- Alavi Estate.
 Ambanpitiya Estate.
 Ankande Estate Co. of Ceylon, Ltd.
 Apthorpe Estates, Ltd.
 Aranayaka Rubber Co., Ltd.
 *Atherfield Tea and Rubber Co., Ltd.
 Avington Tea and Rubber Co., Ltd.
 *Beie Ferrers Estate. [Ltd.
 Cerlon Amalgamated Tea and Rubber Co.,
 Ceylon Land and Produce Co., Ltd.
 Clunes Estates Company of Ceylon, Ltd.
 Cocoawatte (Ceylon) Rubber and Tea
 Estates, Ltd.
 Colombo Commercial Co., Ltd.
 Cullen Estate.
 Dorset Rubber Estate Co., Ltd.
 Duhallow Estate.
 Eila Tea Co., Ltd.
 Estates Co. of Uva, Ltd.
 Farnham Estate Co., Ltd.
 Fernlands Tea Co., Ltd.
 Gallabodde Estate Co. of Ceylon, Ltd.
 Gallawatte (Ceylon) Rubber Co., Ltd.
 Ganapalla Estate Co., Ltd.
 Gikiyanakande Estate.
 Giragoda Rubber Co., Ltd.
 Golinda Tea and Rubber Co., Ltd.
 Guava Hill Estate.
 Gurudola Estate.
 Hantane and Bollagalla Estates Co., Ltd.
 Hatbawa Rubber Co., Ltd.
 Haydella Tea and Rubber Estates, Ltd.
 *Hegalla Group.
 Hinwerelle Rubber Co., Ltd.
 Horawla (Kalutara) Rubber Co., Ltd.
 Hulundawa Rubber and Tea Co. (Ceylon).
 Hunuwella (Pelmadulla) Rubber Co., Ltd.
 Ilwana Estate.
 Jambulande Tea and Rubber Estates, Ltd.
 Kaluganga Valley Tea & Rubber Co., Ltd.
 Kalutara Co., Ltd.
 Kalutare Rubber Co. of Ceylon, Ltd.
 Kanana Rubber Estate Co., Ltd.
 Kandyan Hills Co., Ltd.
 Karandupona Estates Co., Ltd.
 Katiapola Rubber Co., Ltd.
 Kelani Tea Garden Co., Ltd.
 Kelani Valley Rubber Co. of Ceylon, Ltd.
 Kinnersley (Kalutara) Rubber Co., Ltd.
 Kiriella Estate Co., Ltd.
 Kurunegala Rubber Co., Ltd.
 Kuttapitiya Tea and Rubber Co., Ltd.
 Lansdowne Rubber Co., Ltd.
 Lassahena Rubber Co., Ltd.
 L. L. P. Estates, Ltd.
 Lipton, Limited.
 Lunugala Tea and Rubber Co., Ltd.
 Lyegrove Rubber Co., Ltd.
 Macaldeniya Tea and Rubber Co., Ltd.
 Mahagama Rubber Co., Ltd.
 Mapitigama Estate.
 Matale Valley Cacao and Rubber Co., Ltd.
 Meall Mor (Ceylon) Estates, Ltd.
 Mocha Tea Co. of Ceylon, Ltd.
 Moneragalla Rubber Co., Ltd.
 Morakelle Rubber Co., Ltd.
 Mukulana Estate.
 Neuchatel Estates, Ltd.
 Niriwatte Co., Ltd.
 North Western Rubber Co., Ltd.
 Nottingham Estate.
 Opalgalla Tea and Rubber Estates, Ltd.
 Opata Tea and Rubber Co., Ltd.
 Panana (Kegalla) Rubber Co., Ltd.
 Peacock and Nilambe (Ceylon) Tea and
 Rubber Estates, Ltd.
 Piccadilly (Kelani Valley, Ceylon) Rubber
 and Tea Estates, Ltd.
 Pine Hill Estates Co., Ltd.
 Poonagalla Valley (Ceylon) Co., Ltd.
 Ragama Tea and Rubber Co., Ltd.
 Ratwatte Cocoa Co., Ltd.
 Rayigam Co., Ltd.
 Ruanwella Tea Co., Ltd.
 Rubber Plantations of Kalutara, Ltd.
 Ryan Estates (of Ceylon), Ltd.
 Sheldon Estates, Ltd.
 Sitawaka Tea and Rubber Co., Ltd.
 Sunderland (Ceylon) Rubber Co., Ltd.
 Syston Estates Co. of Ceylon, Ltd.
 Tannahena Rubber Estates, Ltd.
 The Ambalawa Estate Co. of Ceylon, Ltd.
 The Damblagolla Rubber Estates, Ltd.
 The Diwala (Kegalla) Rubber Co., Ltd.
 The Lagos (Ceylon) Rubber Co., Ltd.
 The Walakande Rubber Co., Ltd.
 Tillyfour Rubber Co., Ltd.
 Tudugalla Estate.
 Udabage Tea and Rubber Co., Ltd.
 Udagoda Tea and Rubber Co., Ltd.
 Udakelle Rubber Co., Ltd.
 Udapolla Rubber Co., Ltd.
 Ullswater Rubber Co. of Ceylon, Ltd.
 Usk Valley (Kalutara) Rubber Co., Ltd.
 Uva Rubber Co. of Ceylon, Ltd.
 Vauxhall Rubber Co., Ltd.
 Vincit Tea and Rubber Co., Ltd.
 Walahanduwa Estate.
 Walker, Sons, & Co., Ltd.
 Warriapolla Estates Co., Ltd.
 Watapota Rubber and Tea Estates, Ltd.
 Wawulugalla Estate.
 Wellandura Tea and Rubber Co., Ltd.
 Weniwella Rubber Co., Ltd.

APPENDIX No. II.

BULLETINS.

- | | | |
|-----|-----|--|
| No. | 1. | The Effect of Tapping on the Movements of Plant-Food in <i>Hevea brasiliensis</i> . |
| " | 2. | The Effect of Tapping on the Movements of Plant-Food in <i>Hevea brasiliensis</i> (continued). |
| " | 3. | Seasonal Variations in the Movements of Plant-Food in <i>Hevea brasiliensis</i> , Part I. |
| " | 4. | The Physiological Effects of Various Tapping Systems, Part I. |
| " | 5. | Progress Report on Vulcanization Tests. |
| " | 6. | The Physiological Effects of Various Tapping Systems, Part II. |
| " | 7. | The Physiological Effects of various Tapping Systems, Part III. |
| " | 8. | Seasonal Variations in the Movements of Plant-Food in <i>Hevea brasiliensis</i> , Part II. |
| " | 9. | Vulcanization Tests. |
| " | 10. | Vulcanization Tests. |
| " | 11. | Variability in the Rubber Manufacture. |
| " | 12. | Progress Report of the Rubber Research Chemist. |
| " | 13. | Vulcanization Tests. |
| " | 14. | On the variation in the number of Latex Vessels present in <i>Hevea brasiliensis</i> . |
| " | 15. | Vulcanization Tests. |
| " | 16. | On the Natural Clotting of Rubber Latex. |
| " | 17. | Vulcanization Tests. |
| " | 18. | Measurements of "Bark Renewal." |
| " | 19. | Vulcanization Tests. |
| " | 20. | Vulcanization Tests. |
| " | 21. | Vulcanization Tests. |
| " | 22. | Vulcanization Tests. |
| " | 23. | Vulcanization Tests. |
| " | 24. | Vulcanization Tests. |
| " | 25. | Vulcanization Tests. |
| " | 26. | Results of the trials of Ceylon Rubber for the Manufacture of Ebonite. |
| " | 27. | Vulcanization Tests. |
| " | 28. | Vulcanization Tests. |
| " | 29. | Summary of Results of Vulcanization Tests. |
| " | 30. | The Penetration of Disinfectants on the Tapping Cut of <i>Hevea</i> . |
| " | 31. | On the Occurrence of Rust on Sheet Rubber. |
| " | 32. | On the "Preservation of Latex." |
| " | 33. | Variability of Plantation Rubber, 1st Interim Report (New Series). |
| " | 34. | Variability of Plantation Rubber, 2nd Interim Report (New Series). |
| " | 35. | Variability of Plantation Rubber, 3rd Interim Report (New Series). |
| " | 36. | Variability of Plantation Rubber, 4th Interim Report (New Series). |
| " | 37. | Variability of Plantation Rubber, 5th Interim Report (New Series). |
| " | 38. | Variability of Plantation Rubber, 6th Interim Report (New Series). |
| " | 39. | Variability of Plantation Rubber, Final Report (New Series). |
| " | 40. | Vulcanizing and Mechanical properties of Wet Rubber. |
| " | 41. | 1st Interim Report on Artificial Ageing Tests on Plantation Rubber. |
| " | 42. | On the Smoking of Sheet Rubber in Relation to Mould Prevention. |
| " | 43. | The Inter-relationship of Yield and the various Vegetative Characters in <i>Hevea brasiliensis</i> . |
| " | 44. | The Construction of Smoke-houses for Small Rubber Estates. |

APPENDIX No. II.—*Contd.***CIRCULARS.**

No.		No.	
1.	Research Work in Ceylon (17-2-21).	11.	Third Quarterly Circular for 1924.
2.	Budding and Grafting of Rubber (2-9-21).	12.	Fourth Quarterly Circular for 1924.
3.	Research Work in Ceylon (5-9-21).	13.	First Quarterly Circular for 1925.
4.	Scale of Subscriptions (27-2-22).	14.	Second Quarterly Circular for 1925.
5.	Research Work in Ceylon (1-7-22).	15.	Third Quarterly Circular for 1925.
6.	Rust and Mould on Sheet Rubber.	16.	Fourth Quarterly Circular for 1925.
7.	Research Work in Ceylon.	17.	First Quarterly Circular for 1926.
8.	Shipment of Latex.	18.	Second Quarterly Circular for 1926.
9.	First Quarterly Circular for 1924.	19.	Third Quarterly Circular for 1926.
10.	Second Quarterly Circular for 1924.	20.	Fourth Quarterly Circular for 1926.

APPENDIX No. III.

SCALE OF SUBSCRIPTIONS.

					£.	s.	d.
No Output	...	...	...	...	10	10	0
Output up to and not exceeding	100,000 lbs.	...	...	...	15	15	0
Exceeding 100,000 lbs. not exceeding	200,000 „	...	...	...	21	0	0
Do 200,000 „	do 300,000 „	...	...	...	26	5	0
Do 300,000 „	do 400,000 „	...	...	...	31	10	0
Do 400,000 „	do 500,000 „	...	...	...	36	15	0
Do 500,000 „	do 600,000 „	...	...	...	42	0	0
Do 600,000 „	do 700,000 „	...	...	...	47	5	0
Do 700,000 „	do ...	...	...	...	52	10	0

For conversion purposes the rate of exchange is the Bank's selling rate for Demand Drafts on London on 15th January or July respectively.

ESTIMATES OF INCOME AND EXPENDITURE
FOR 1927.

REVENUE STATEMENT.**CEYLON.**

			Rs.	c.	Rs.	c.
Balance at December 31st, 1926	...	...	126,288	78*		
Less Sundry Creditors (approximate)	...	...	1,446	96	124,841	82

Income for 1927.

Government Grant for 1926/27	...	...	67,500	00		
Local Subscriptions, 1927	...	...	30,000	00		
Interest on Deposit and Current Accounts	...	...	3,000	00		
Rent on Culloden Bungalows	...	...	1,450	00	101,950	00
			Total Rs.	...	226,791	82

LONDON.

				£.	s.	d.
Balance at December 31st, 1926	...	...	...	368	14	7

Income for 1927.

Contribution from Rubber Growers' Association	...	...	2,000	0	0
Interest on balances	...	...	40	0	0
			Total	£2,408	14 17

* Of this balance Rs. 6,645/25 is on credit to the Current Account of the Bonus and Passage Fund.

